The other possible cause of separation would be that the times of the tide produced by the sun's attraction coincided with the period of gravitational oscillation of the mass of the spheroid; that is, that the period of free oscillation would be the same as that of the forced oscillation due to the solar tide. After this had gone on for some while, the tidal protuberances would become so large that, in the opinion of Sir G. H. Darwin, one (or both) might break away. He considered that the rate of rotation in this case would have been about one revolution in five hours. And it was this rate that I assumed in my letter to Nature. By the time the earth's rotation had been reduced so far as this, it does not seem impossible that a crust might have been formed.

If the material which now constitutes the moon was in any way detached from the earth, the matter so detached cannot have coalesced into a single sphere until Roche's limit was passed, which would be 2·44 of the earth's radii from its centre. During this initial stage of the moon's existence the nearest analogy seems to be found in Saturn's rings. But the difficulty remains why the matter detached should not have fallen back again.

As regards the formation of mountains by the contraction of the earth, I have discussed the question to the best of my ability in my "Physics of the Earth's Crust," and have come to the conclusion that the theory is untenable.

O. Fisher.

Graveley, Huntingdon, April 4.

Movements on Water Surfaces.

I have often wondered what is the real explanation of the following observation. If on a bath of soapy water a skin is allowed to collect on the surface, and then lumps of soapy lather be allowed to drop from one's hands on to it, the skin will crack in all directions, radiating from the point where the skin was first pierced, and this will continue for some time after the initial cause of the disturbance has ceased. The phenomenon is very striking, and can be repeated several times, after which the effect cannot be produced. Also if a cake of wet soap be placed on a wet level surface, the moisture is repelled from the cake, until the latter becomes surrounded by a dry patch. These seem to suggest repulsion of similarly electrified bodies.

Edward A. Martin.

Mr. Martin's second question is more easily answered than his first. The surface tension of clean water is about three times as great as that of water containing soap, so when the soap touches the wet surface the surrounding wet being no longer pulled towards the soap as strongly as it is pulled away, obeys the latter force as fast as it can.

I am inclined to think that his first observation may relate to a similar phenomenon, but of this I am not sure. With oleate of soda a very small quantity reduces the tension to the lower limit at once, and with this I do not think the experiment would succeed. I can only suppose, but I do not know it as a fact, that with the soap used first a scum is formed, and then when fresh lather breaks this at a point there is rather less surface tension at this point than there is in the surrounding surface. If so, the result observed would naturally follow. I should not, however, have expected to find this difference in the surface tensions. Or, possibly, the lather from the hand is warmer and for this reason has somewhat less surface tension. I have often shown in a striking way the diminution of surface tension with rise of temperature by holding the hand steadily against one side of the rainbow cup when the film upon it is already thin and highly coloured. Almost immediately a circulation is set up and a stream leaves the part warmed by the hand, and crossing the film diametrically, curls round on either side, producing a tree-like pattern in other colours. The film is very sensitive to temperature changes.

C. V. Boys.

66 Victoria Street, London, S.W., April 24.

X-Ray Spectra.

J. Herweg (*Berichte der Deutschen Physikalischen Gesellschaft,* Heft 1, 1914) using a crystal of gypsum, obtains by means of the photographic method the result that the α and β lines of the tungsten X-ray spectrum coincide with the α and β lines of the platinum X-ray spectrum, the values of the glancing angles being $4^\circ\ 56'$ and $4^\circ\ 16'$ for the α and β lines respectively. But there is reason to suppose that the wave-length of X-rays characteristic of an element varies inversely as the square of the atomic weight of that element. If this is so, we can calculate from the experimental results for a platinum antikathode obtained by Herweg the glancing angles for the tungsten X-ray spectrum and we obtain:—

Tungsten Antikathode (Calculated).

Spectrum line	α	β	γ	δ	ϵ
Glancing angle	$5^\circ\ 34'$	$4^\circ\ 48'$	$4^\circ\ 43'$	$4^\circ\ 6'$	$3^\circ\ 51'$

We thus see that the calculated values of the β and δ lines are nearly the same as the experimental values found by Herweg for what he calls the α and β lines of the tungsten spectrum.

G. E. M. Jauncey.

Physical Laboratory, University of Toronto,
March 30.

An Optical Illusion.

I have often noticed the phenomenon mentioned by Mr. J. W. Giltay in Nature of April 23 (p. 189). In the position in which he was reading the sunlight passed through his eyelids and the coats of his eyes, and on account of having to pass through a layer of blood which acted as a red screen his retinas become flooded with red light. The red is not noticed where it is diluted with white, but the print appears red because red light is falling on the portions of the retina which receive the images of the printed letters.

F. W. Edridge-Green.

SOME LIFE-HISTORIES AND HABITS OF INSECTS.[1]

(1) In his "Insect Biographies," Mr. J. J. Ward has written a pleasant and popular account of the life-history of several of our best-known insects. He has contrived to show how full of interest are the facts concerning the growth, development, and general mode of life of the subjects of his pen and camera, without overburdening his pages with technicalities, or, on the other hand, being guilty of inaccuracy or looseness of statement. The photographs with which the book is plentifully illustrated have been in almost every instance taken directly from living specimens in their natural attitudes and surroundings, and their execution must have involved the

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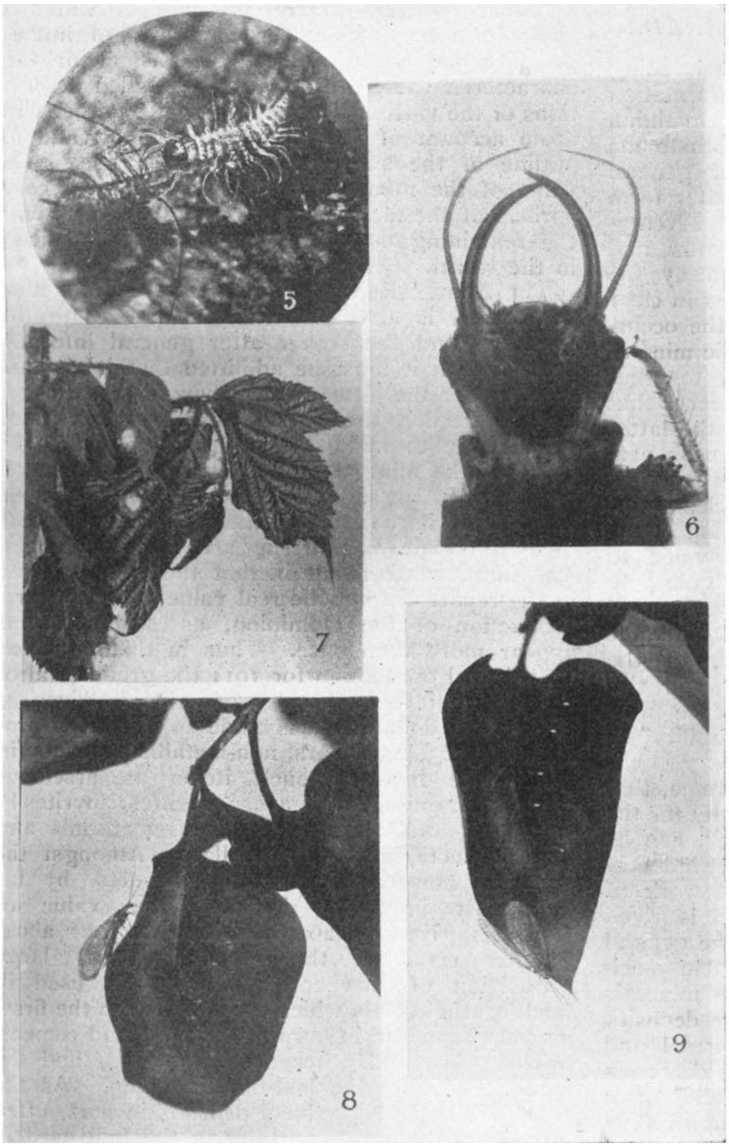
[1] (1) "Insect Biographies with Pen and Camera." By John J. Ward. Pp. 206+plates. (London: Jarrold and Sons. 1913.) Price 6s. net.

(2) "Lebensgewohnheiten und Instinkte der Insekten bis zum Erwachen der sozialen Instinkte." Geschildert von O. M. Reuter. Vom Verfasser revidierte Uebersetzung nach dem schwedischen Manuskript besorgt von A. u. M. Buch. Pp. xvi+448. (Berlin: R. Friedlander und Sohn, 1913.) Price 16 marks.

expenditure of much time and patience. They form an important feature of the work, and are in most cases excellent examples of their kind; some of them, however, are too much reduced in size for perfect clearness. One of the best illustrations shows the extraordinarily indented outline of the "Comma" butterfly (*Vanessa C-album*) in its attitude of rest with closed wings. The eggs and larvæ of the common lace-wing fly (Chrysopa), valuable for its destructive activity among the aphides, form the material of a series of figures some of which are here reproduced, while the life-history of another foe to the aphid pest, the wasp-like hover-fly or syrphid, is also well illustrated on Mr. Ward's photographic plates. One of the best chapters in the book is that devoted to the subject of the tree- and ground-wasps; the construction of the nests is clearly explained and well figured. Another interesting section is that which deals with the hornet-like clear-wing moth (*Aegeria crabroniformis*), remarkable in its larval stage for its powers of burrowing in the trunks and branches of various species of willow. Much stress is laid throughout the book on the protective value of the forms and colours adopted by many of the subjects of illustration, and the author has ingenious explanations to offer of the meaning of several curious instincts, such as the wholesale destruction of wasp larvæ by the workers towards the end of the season. Mr. Ward's bionomic conclusions are for the most part well grounded, but he seems in some passages somewhat too ready to admit without question the interpretation of instinct as inherited habit.



5. Larva of the lace-wing fly attacking an aphis. 6. Head of the larva. 7. Cocoons formed by the larvæ. 8. Lace-wing fly depositing eggs on a lilac leaf. 9. Another view of the lace-wing fly and eggs. 5 and 6 are enlarged, and 7, 8, 9, are actual size. From "Insect Biogaphies with Pen and Camera."

(2) The name and reputation of the late Dr. Odo Reuter were a sufficient ground for the anticipation that his work on the habits and instincts of insects would be a contribution to entomological science of high value. Such expectations are fully borne out by the work before us, which has been translated into German by A. and M. Buch from the original Swedish. The various heads of the subject are treated with great care and thoroughness, and the importance of the book as a work of reference is enhanced by the useful list of recent literature which concludes the volume. Among the topics dealt with are the various manifestations of activity and rest, including sleep and hibernation, the instincts concerned in feeding, in parasitism, commensalism, and mutualism. A chapter is devoted to the subject of migration; and the various methods of protection, active and passive, against unfavourable natural conditions, and the attacks of insectivorous foes, receive extended treatment. Instincts associated with metamorphosis, with pairing, with oviposition, and provision for the future needs of the offspring, are also fully discussed; and much space is given to the nesting and feeding habits of the solitary bees and wasps. The treatise concludes with a consideration of the transition from the solitary to the social habit in insects.

Dr. Reuter brought together for this work a great quantity of information gathered from the recorded observations of many naturalists in different countries. The treatment can scarcely be called exhaustive, and it is almost inevitable that some parts of so wide a subject should be dealt with in greater detail than others of equal importance. But the book is a useful storehouse of facts, selected with discretion, arranged with judgment, and pleasantly recounted.

F. A. D.

THE MINERAL INDUSTRY OF CANADA.[1]

THE Department of Mines of Canada is doing excellent work in distributing information concerning the mineral wealth of the Dominion by means of publications that appeal both to the trained expert and to the seeker after general information. A good example of the latter form may be found in a pamphlet of some seventy-seven pages entitled "Economic Minerals and Mining Industries of Canada," written by the "Staff of the Mines Branch," which gives in clear and convenient form a brief review of the occurrences and distribution of all the economic mineral products of the Dominion of Canada, together with indications of the legislative enactments that control the tenure of mineral property, the latter being especially important, seeing that each province has its own mining laws. This popular description, which, though brief, is clear and easily intelligible to anyone interested in mining matters, should prove of the utmost value to prospectors or others who may be going to Canada and are anxious to acquire some general knowledge of the more important economic minerals that are found in Canada, of the districts in which they chiefly occur, and the conditions under which their occurrence may be looked for with the greatest probability of success.

No better example of the opposite extreme, that is to say, of publications written essentially for the trained mining or metallurgical engineer, can be quoted than the monograph on the nickel industry of Sudbury by Dr. A. P. Coleman, a work of some 200 pages, in which a full account is given of these important mineral deposits. The general geology of the region is first described in much detail, then descriptions of the various minerals met with and of typical forms of the ore deposits themselves, all of these being very careful and apparently very accurate. Dr. Coleman discusses the mode of formation of the deposits, and seems inclined to adopt the magmatic segregation theory in its simplest and most definite form; he certainly mentions the researches of Dr. Campbell and others which have shown that there is very much to be said in favour of the aqueous origin of the ores, but Dr. Coleman apparently lays but little stress on these. He does not appear to have considered the possibility that these conflicting views might be reconciled on the hypothesis that the ores might have been formed by some form of hydrothermal process, in which separation from a cooling magma in the presence of water in some form or other under conditions of intense pressure may have produced the phenomena that characterise these ore deposits. Detailed descriptions of the various mines are given, together with some account of the method of mining and an outline of the smelting processes in use. The value of the monograph is enhanced by a comparison of the nickel occurrences at Sudbury with the remaining most important sources of nickel in the world.

The Annual Report on the Mineral Production of Canada is a volume that interests both the specialist and the seeker after general information, though it must be admitted that it appears to cater for the latter rather than for the former class of reader, there being throughout evidence of a desire to make the figures, especially the value of the mineral production of Canada, look as large as possible. No doubt the pernicious example of its neighbour, the United States, has much to do with this striving after inflated figures. The unfortunate result is that the figures given in the report are not the real value of the mineral production of the Dominion, as several items appear more than once. Thus in the report on the mineral production for 1911 the grand total of the value of the mineral production is given as 103,220,994 dollars; this is made up of metallic products, 46,105,423 dollars, non-metallic products (in which are included such items as arsenious oxide, chromite, manganese, ochres, pyrites!), 34,405,960 dollars, and structural materials and clay products, 22,709,611 dollars. Amongst the so-called non-metallic mineral products, by far the most important is coal, the value of which is given as 26,467,646 dollars, or about 77 per cent. of the whole; a very large proportion of this coal is, however, used in smelting the metals which are included in the first-named group and in burning the Portland cement, bricks, tiles, and other ceramic goods, and the lime included in the last-named group. As the value of all these products depends in part, often in quite considerable part, upon the fuel used in their production, the value of the coal appears twice over in the above grand total. Furthermore, very large quantities of coal and coke are imported into Canada, their value in 1911 exceeding 41,000,000 dollars, and it is certain that a very large proportion of this imported fuel is also used in manufacturing the metallic and other products above referred to, so that the value assigned to these includes in no small part the value of the imports of coal, etc. In spite of these facts, which show that the value of the mineral products of

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[1] "The Nickel Industry: with Special Reference to the Sudbury Region, Ontario." By Dr. O. P. Coleman. (Ottawa: Government Printing Bureau, 1913.)

"Annual Report on the Mineral Production of Canada during the Calendar Year 1911." By John McLeish, Chief of the Division of Mineral Resources and Statistics. (Ottawa: Government Printing Bureau, 1913.)

"Economic Minerals and Mining Industries of Canada." By the Staff of the Mines Branch. (Ottawa: Government Printing Bureau, 1913.)

"A General Summary of the Mineral Production of Canada during the Calendar Year 1912." By John McLeish (Ottawa: Government Printing Bureau, 1913.)

"The Production of Copper, Gold, Lead, Nickel, Silver, Zinc, and other Metals in Canada during the Calendar Year 1912." By Cosmo T. Cartwright. (Ottawa: Government Printing Bureau, 1913.)

"Summary Report of the Mines Branch of the Department of Mines for the Calendar Year ending December 31, 1912." (Ottawa, 1913.)